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ABSTRACT

Two experiments are reported that compared incentive motivation for studying, based on a weekly quiz in a course, to a metacognitive strategy for studying, based on identifying key terms, and providing definitions and elaborations as homework. In the first experiment, with a sample of 109 students enrolled in an educational psychology class, the study spanned a five-week period, and a control group was also included. On the achievement test at the end of the time period, students having the test as an incentive outscored the homework group by over 10 points and the control group by over 15. In the second experiment, with a sample of 117 students from the same populations, enrolled in the same course, the study spanned a 15-week period, and students were subdivided for statistical purposes into high, medium, and low groups on prior grade point average (GPA). The results showed that the advantages of the test incentive condition over three achievement tests accrued primarily to students of low GPA. The results were interpreted to indicate that college students may already have acquired metacognitive strategies suitable for studying text, but are less likely to use them unless sufficiently motivated. Two figures and two tables present study data. (Author)

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Comparing Incentive Motivation to Metacognitive Strategy in Its Effect on Achievement

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ABSTRACT

Two experiments are reported that compared incentive motivation for studying, based on a weekly quiz in a course, to a metacognitive strategy for studying, based on identifying key terms, and providing definitions and elaborations as homework. In the first experiment, with a sample of 109 students enrolled in an educational psychology class, the study spanned a five-week period, and a control group was also included. On the achievement test at the end of the time period, students having the test as an incentive outscored the homework group by over 10 points and the control group by over 15. In the second experiment, with a sample of 117 students from the same population, enrolled in the same course, the study spanned a 15-week period, and students were subdivided for statistical purposes into high, medium, and low groups on prior grade point average (GPA). The results showed that the advantage of the test incentive condition over three achievement tests accrued primarily to students of low GPA. The results were interpreted to indicate that college students may already have acquired metacognitive strategies suitable for studying text, but are less likely to use them unless sufficiently motivated.

Experiment I was reported on at the annual meeting of the American Psychological Association, Toronto, Canada, 1993. Experiment II was reported on at the annual meeting of the American Educational Research Association, New Orleans, LA, 1994.

Comparing Incentive Motivation to Metacognitive Strategy in Its Effect on Achievement

From the middle 1950's to the early '70's, incentives figured prominently in social psychological theories of motivation. Atkinson refined the Lewinian approach to motivation, first proposed in 1935, that an object acquired a valence, or incentive value, by being able to satisfy a need, and that performance toward a goal was motivated by the valence or incentive value of a goal object. Atkinson (1957, 1964) proposed that the tendency to approach an achievement-related goal was a function of three factors, the motive for success, the probability of success, and the incentive value of success. For Atkinson, the essential incentive was "pride in accomplishment," but it was invariably associated with some specific external outcome such as a high grade in a course.

Rotter (1954; Rotter, Chance, and Phares, 1972) proposed that the motivation to act was jointly a function of the expectancy of reward and the reward value of the goal. Rotter (1954) defined reinforcement value as "the degree of preference for any reinforcement" (p. 107). He acknowledged that this value may come from a combination of similtaneous internal and external factors. Vroom (1964) also proposed that the motivation to act was a joint function of reward expectancy and reward value, and that reward value was the anticipated satisfaction one has toward a particular environmental stimulus. A stimulus, therefore, is positively valued, according to Vroom, when a person prefers attaining it to not attaining it.

A more cognitive approach gained emphasis in 1977 when Bandura took the heretofore popular concept of expectancy and divided it into two different kinds of expectations, which he termed self-efficacy expectations and outcome expectations. He defined an efficacy expectation as "the conviction that one can successfully execute the behavior required to produce the outcome" and outcome expectation as "a person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193). Of the two types of expectation, Bandura (1977) proposed and documented self-efficacy to be the more influential. From a formal perspective, the incentive or reward value of an outcome was not considered by Bandura. Rather, the motivation to perform was based on a person's estimate that he or she could successfully carry out the behavior required to attain the outcome. Unlike his predecessors described above, Bandura did not directly consider the attractiveness of the outcome to be a motivational factor.

Kirsch (1982, 1985) took issue with Bandura's formulation of self-efficacy, arguing that self-efficacy was merely a reflection of expectations and incentive value as previously proposed. To demonstrate this Kirsch (1982) presented subjects with a hypothetical feared task, specifically holding a snake in front of their face, and asked them to report their self-efficacy. He then offered them a progressively stronger incentive (namely, more money) and had them report their self-efficacy in each instance. All subjects eventually raised their reported self-efficacy level to a point where they said they would perform the feared task. He concluded that by providing a sufficient incentive to do so, people would become reasonably confident of their ability to perform acts with otherwise negative consequences.

Maddux, Norton, and Stoltenberg (1986) also took issue with self-efficacy theory for disregarding outcome value as a potential influence on behavioral intentions. They showed that outcome value had a significant influence on behavioral intentions, especially among people high in self-efficacy.

Residual interest in the matter of outcome value as a determinant of motivation focused on the locus of that value. Deci and Ryan (1985) distinguished between internal and external motivation, two distinct loci from which incentive value could emanate. They provided strong support for self-determined or intrinsic motivation especially in educational contexts. Deci, Vallerand, Pelletier, and Ryan (1991) concluded that "self-determination, in the forms of intrinsic motivation and autonomous internalization, leads to the types of outcomes that are beneficial both to individuals and to society" (p. 342). It can be argued, however, that in many cases the outcome to be gained goes beyond mere interest or a sense of accomplishment and extends to some outside gain, such as the acknowledgement of some accomplishment by others. While Deci et al. (1991) tend to downgrade extrinsic motivation, they do acknowledge that external incentives can, in some cases, become personally important, a circumstance they label as "integrated regulation."

The value of an outcome represents one of three categories of motivational components according to Pintrich and Schrauben (1992), who further subdivided this component into goal orientation beliefs and task value beliefs. Two goal orientations, intrinsic and extrinsic, are then identified, consistent with Deci et al. (1991) above and others. Harter (1981) also distinguished between intrinsic rationales and extrinsic considerations, while Dweck and Elliott (1983) preferred the terms

learning goals and performance goals, and Nicholls (1984), task involvement and ego involvement. In all of these formulations, it is made clear than intrinsic motives are more constructive or desirable than extrinsic ones. Lepper, Greene, and Nisbett (1973) go so far as to propose that extrinsic motives interfere with intrinsic ones, the so-called "overjustification hypothesis." Of course, it is possible that extrinsic incentives can lead to internalized goals, or can affect the choice among competing internalized ones.

Besides motivation, there is a second variable that is regarded as a major influence on intellectual achievement, and that is metacognitive strategy, including rehearsal, elaboration, and organizational strategies, as described and summarized by Weinstein and Mayer (1986), and as self-regulation strategies as described by Pintrich (1989) and Zimmerman and Pons (1988). As reviewed by McKeachie, Pintrich, Lin, and Smith (1986) for the college setting, learning to use a metacognitive strategy tends to have a positive impact on subsequent achievement.

Pintrich and Schrauben (1992) propose that motivation leads to cognitive engagement, and that cognitive engagement often takes the form of metacognitive strategy use. If by college age students have already learned a variety of metacognitive strategies, then the improvement of their achievement via cognitive engagement would not require additional training or use of such strategies, but rather that they be motivated to use the strategies already available to them. It is rather like the famous latent learning paradigm of Tolman (see Tolman and Honzik,1930), where animals placed in an alley without food in the goal box did not traverse the alley. However, when food was added some days later, they immediately

traversed the alley. It was the availability of food that led them to demonstrate what they had already learned.

The purpose of the present two studies was to compare achievement outcomes in classes where the incentive value for regular cognitive engagement was high, but metacognitive strategies were neither taught nor their use required, to classes where incentive value for regular cognitive engagement was low, but metacognitive strategy use was both taught and practiced. The incentive value for regular cognitive engagement or self-regulation was elevated by beginning the work on each chapter of a course with a test (or spotquiz), while the requirement for metacognitive strategy use with which that was compared was having to prepare lists of definitions and elaborations of major terms in each chapter as homework assignments. The second study represented both an attempt to replicate the first, and to examine any differences that occurred as a function of students' prior academic performance, a presumed indicator of typical patterns of cognitive engagement.

The motivational effect of an incentive to achieve was expected to exceed the effect of specific metacognitive strategy use in the absence of an incentive. This expectation is largely based on the results of two path analytic studies of the influences on school achievement. Sexton, Tuckman and Crehan (1992), using college students, showed that self-ratings of the value of performing a task to earn bonus points toward the final grade was second only to prior performance on the task as a predictor of final level of performance, and far exceeded the effect of perceived self-efficacy. Zimmerman, Bandura, and Martinez-Pons (1992) also report a path analytic study of academic performance, in this case among high school students (ninth and tenth graders). The outcome to be predicted was also

one of external performance, namely final grades in social studies. In the final path model, final grades were found to be most influenced by student grade goals (beta=.43), and only secondarily by self-efficacy for academic achievement (beta=.21). The student grade goals can be considered the incentive value of the outcome because they were based not only on the grade they had set as their goal, but also on the lowest academic grade students said they would find satisfying.

EXPERIMENT I

METHOD

Subjects. 109 juniors and seniors in college, all preparing to be teachers as either a major or a minor, participated in the study. The average age was 21, and two-thirds were women. They were enrolled in three sections of an educational psychology course required for teacher certification during the summer term. All three sections met once a week (on consecutive days) at the same time of day, covered the same content (learning theories), used the same textbook, and were taught by the same instructor. A comparison of the three classes on age, gender, and scores on the verbal portion of the College Level Academic Skills Test (CLAST) showed them to be equivalent, thus satisfying the requirements for a quasi-experimental design. Correlations between CLAST verbal scores and achievement in this course have been found to be about .5 (Tuckman, 1993).

The course was divided into three segments, each of which was followed by an achievement test. Only the first segment of five weeks was included in this study. Classes were randomly assigned to conditions.

Treatments. (1) *Spotquizes (high incentive, low metacognitive strategy).* One class was given a seven-item, completion-type test at the beginning of each class period, covering the textbook chapter assigned for that week. The quiz was projected via an overhead projector. Fifteen minutes were allowed for its completion. At the time of the spotquiz, no instruction had yet been given on the chapter covered. The only informational resource was the textbook itself. Following the spotquiz, students exchanged papers, and the answers were gone over by the instructor so that students could grade one another's tests. Students were informed that the average of their spotquiz grades would count toward their final grade as much as the end-of-segment achievement test.

(2) *Terms/Definitions/Elaborations (low incentive, high metacognitive strategy).* One class was given the homework assignment of identifying the 21 most important terms in the assigned chapter, and preparing a definition of each term along with a one-sentence elaboration of each. This approach is considered to be a cognitive strategy for extracting meaning from text (E. Gagne et al., 1984; King, 1992). Students turned in their lists, and were graded A, B, or C on their quality. These grades were averaged and counted toward the final grade to that exact same degree as did the average of spotquiz grades in the first condition.

(3) *Control (low incentive, low metacognitive strategy).* One class was given only lectures on the chapters. No spotquizes were given, and no homework was assigned.

Dependent Variable. A 50 multiple-choice item test, matched to instructional content, was given to measure end-of-segment achievement. The test had a K-R reliability of .82. There were no items on this test that matched items on any of the spotquizes. Moreover, spotquiz questions were all completion-type, and many were measures of knowledge, while questions on the 50-item examination were all multiple-choice, and most were measures of comprehension.

Interviews. At the conclusion of the segment, four students, chosen at random from each class, were interviewed to discover their studying behaviors.

RESULTS

The final achievement test results for the three approaches are as follows: (1) Spotquiz mean=82.8 (n=36, sd=9.3), (2) Terms/Definitions/Elaborations mean=71.6 (n=35, sd=9.4), (3) Control mean=66.9 (n=38, sd=12.6).

ANOVA for condition yielded $F=21.69$ ($df=2/106$), $p<.001$. Cell comparisons by Newman-Keuls test showed the spotquiz approach to yield significantly better results ($p<.001$) than either of the other two conditions, while terms/definitions/elaborations exceeded the control at the $p<.10$ level. The effect size is near or above 1.00 for each comparison with the spotquiz results. These results are also shown in Figure 1.

Insert Figure 1 about here

Interviews with students indicated that spotquiz students read and either outlined or highlighted the chapter prior to the spotquiz, and then studied their outline or highlights again immediately prior to the quiz.

They also engaged in self-monitoring behavior (i.e., checking their own understanding of the material they had read), a behavior regarded as an important aspect of self-regulated learning (Zimmerman and Martinez-Pons, 1988). Students indicated a strong motivation to do well on the quizes because of their effect on the grade.

Students doing the terms/definitions/elaborations worked primarily with the chapter summaries, and focused more on the homework task than on fully understanding the entire contents of the chapter. They also discovered what to do to get A's on the assignment which, as they confessed, "took the pressure off."

Control group students either skimmed the chapter before class or did not even read it until prior to taking the end-of-segment examination. They spent their time instead working on their "tougher" and "more demanding" courses.

It would appear that, as hypothesized, the spotquizes provided an incentive value for studying. Students seemed to possess the necessary metacognitive strategies for studying effectively, but without an incentive for studying, those strategies were not employed.

Experiment II was undertaken as an attempt to replicate Experiment I, particularly given the magnitude of the results, as well as to determine whether any differential effect between approaches would vary as a function of students' prior achievement. Prior performance in college courses was viewed, at least in part, as a manifestation of typical study patterns.

EXPERIMENT II

METHODS

Subjects. 117 juniors and seniors in college, all preparing to be teachers as either a major or a minor, participated in the study. The average age was 21, and two-thirds were women. They were enrolled in two sections of an educational psychology course required for teacher certification. A comparison of the two classes on age, gender, scores on the verbal and on the mathematics portion of the College Level Academic Skills Test (CLAST), prior semester's GPA, and self-rated grade expectation showed them to be equivalent. This was the same population and the same course used in Experiment I, but the students themselves were different.

Both sections met twice a week (at the same time of day), covered the same content (learning theories), and used the same textbook. One was taught by an experienced professor (the one assigned to the terms/definitions/elaborations or TDE condition) and the other by a first-time graduate student (the one asigned to the spotquiz condition). Teaching assignments were done to give the TDE class the instructional advantage. Unlike in Experiment I where only one five-week segment of the course was used, in this experiment all three five-week segments were used.

Treatments. (1) *Spotquizes (high incentive, low metacognitive strategy).* The class taught by the graduate teaching assistant was given a seven-completion-item spotquiz (SQ) at the beginning of each class period, covering the textbook chapter assigned for that week. Items did not overlap in either style or content with the achievement tests. The exact same procedure was followed as in Experiment I. Students were informed that the average of their spotquiz grades would count toward their final grade as much as one end-of-segment achievement test.

(2) *Terms/Definitions/Elaborations (low incentive, high metacognitive strategy).* The professor's class was given the homework assignment of identifying the 21 most important terms in the assigned chapter, and preparing a definition along with a one-sentence elaboration of each one (TDE), again exactly as in Experiment I. Students turned in their lists, and were graded on their quality. These grades were averaged and counted as the equivalent of one achievement test, thus having the same weight as the spotquizes.

Moderator Variable. For analysis purposes, students were divided into high (3.6-4.0), medium (2.9-3.5), and low (2.0-2.8) grade point average (GPA) based on their previous semester's work, as reported in their official college transcripts.

Dependent Variable. Each of the three course segments was followed by a 65 multiple-choice-item achievement test (Tests 1, 2, 3) which matched the content taught during that segment, but did not overlap at all with the spotquizes. Test reliabilities ranged from .81 to .88.

Results

The mean scores on each of the three tests by condition and GPA level is shown in Table 1. Four condition (SQ/TDE) by GPA Level (HI/MED/LO) ANOVAs were run, one for overall achievement (i.e., the three tests combined), and one for each of the three tests individually. The ANOVA results are shown in Table 2. From Table 2 it can be seen that on two of the three tests the main effect of condition was significant, and

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Insert Tables 1 and 2 about here

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on the combined tests it approached significance, reflecting that the spotquiz effect exceeded that of the terms/definitions/elaborations effect.

Additional light is shed on the spotquiz effect by examining the interactions between condition and GPA level, which were significant for overall achievement, and for achievement on

two of the three individual tests. In each instance of significance, the basis for the significant interaction was enhanced performance in the spotquiz condition for students of low GPA, with essentially no differences across condition for students with middle or high GPAs. These differences can be seen clearly in Figure 2.

Insert Figure 2 about here

Hence, for students of low GPA, taking the spotquizes (SQ) greatly enhanced performance in comparison to identifying the terms and writing definitions and elaborations (TDE). For students of high and medium GPA, the spotquizes had little or no effect in comparison to the homework. The fact that the spotquizes enhanced test performance for one but not all of the GPA level groups also indicates that the spotquiz effect is more than just a practice testing effect.

DISCUSSION

It was concluded that taking spotquizes helped students, particularly those of low GPA, perform better on regular achievement tests, in comparison to completing a homework assignment aimed at improving text processing. This finding flies in the face of the

assumption that poorly performing students lack text processing skills. Rather it would appear that they lack the motivation to process the textbook, but have the skill. Given a sufficient incentive, in the form of a quiz, they apparently apply the skill and thereby learn more.

To determine whether study time differences might have accounted for any difference in effect, in Experiment II students were asked to keep track of their time investment on a weekly basis. TDE homework students reported spending 40% more time completing homework assignments than spotquiz students reported studying for spotquizes, indicating that the spotquiz effect was not based on simply the application of greater effort. Particularly for low GPA students, spotquizing was not only a more effective way to stimulate text processing, but also a more efficient motivator than homework.

Based on the time differences from Experiment II cited above, and the interview data from Experiment I, it would appear that quite a few students in the terms/definitions/elaborations condition did not make a connection between the homework activity and studying for the achievement tests. Homework was seen by some as an activity unto itself, different and distinct from studying, and therefore, while taking up time, was not likely to have an impact on achievement. This perception was probably more common among low GPA students than among those in the upper two groups, although no specific data were available to bear on this point.

Regarding the use of intact classes, it must be noted that random assignment to sections of a college course is not possible. Researchers are faced with the choice of establishing equivalence of classes after the fact to justify a quasi-experimental design, creating treatment conditions

in a pull-out, "laboratory" version of the study using random assignment, or doing an ex post facto study using questionnaire data. The use of real classes as part of a real course for which the grades really count was essential to the "ecological" or external validity of this study of incentives, since the spotquiz grade was the incentive studied. Therefore, real (albeit intact) classes were used, and their equivalence established on measures of academic aptitude and motivation. In addition, when the reality of the situation in Experiment II necessitated different instructors, the assignment was made to insure, insofar as possible, that any possible bias would work against the class that was given the spotquizes.

The results of the two experiments strongly suggest that achievement differences among students of college age are based more on motivational differences than on differences in the availability of metacognitive strategies for processing text. If so, strategies for the enhancement of motivation would be expected to be more effective than those aimed at expanding the range of available metacognitive strategies.

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Table 1

Means for Conditions (Definitions/Elaborations or TDE and Spotquizes or SQ) and Their Difference by Prior Grade Point Average Level (High, Medium, and Low) and by Test (1, 2, 3)

	HIGH GPA			MED GPA			LOW GPA		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
TDE	80	81	79	72	75	71	65	69	65
SQ	74	83	80	72	74	73	73	79	75
Diff	-6	+2	+1	0	-1	+2	+8*	+10*	+10*

*p<.05

Table 2

ANOVA of Overall Achievement Test Scores and Scores on Each of the Three Tests by Condition (SQ/TDE) and GPA Level (Hi/Med/Lo)

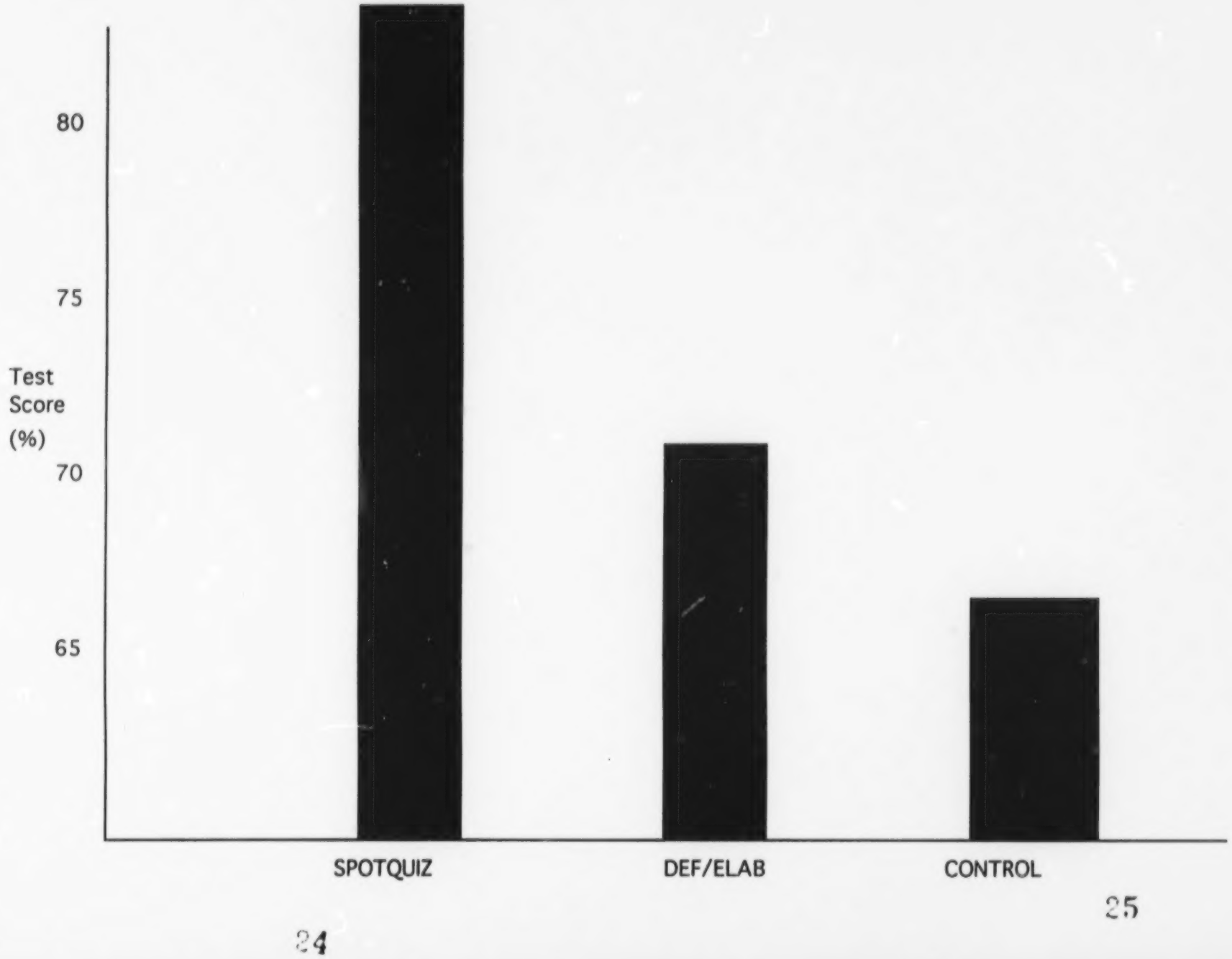
		Overall		Test 1		Test 2		Test 3	
Source	df	MS	F	MS	F	MS	F	MS	F
Condition	1	185.05	2.82+	4.82	0.04	32.54	4.29*	51.91	4.03*
GPA Level	2	667.29	10.16**	56.23	4.71*	82.94	10.94**	91.40	7.10**
Interaction	2	213.65	3.25*	41.31	3.46*	24.61	3.25*	17.21	1.34
Error	109	65.64		11.95		7.58		12.88	

+p<.10, *p<.05, **p<.01

FIGURE CAPTIONS

Figure 1. Mean test scores for the three treatment groups.

Figure 2. Mean test scores for the two treatment groups on each of the three tests across three levels of grade point average (GPA).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Test
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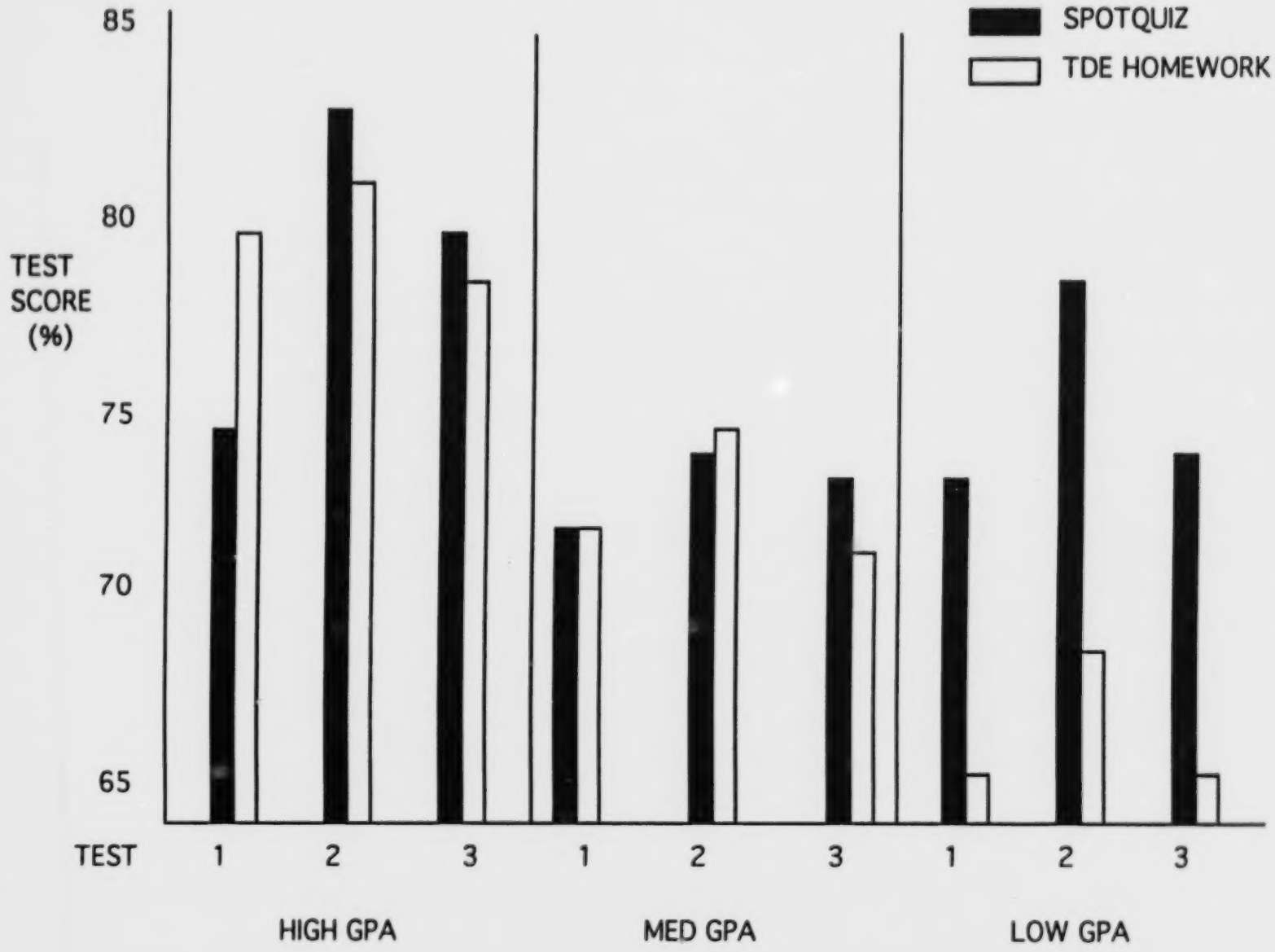
SPOTQUIZ
TDE HOMEWORK
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